

IN THE CLAIMS

Below, please find a clean, unmarked copy of the claims. Please add new claims 18-23. Claims 1-17 are re-presented.

- 9, 1.
- (As filed) A process for fabricating a heat sink, comprising:
providing a heat sink; and
treating the heat sink to a cryogenic quenching process.
2. (Once Amended) The process of Claim 1 further comprising fabricating the heat sink from a metal alloy having precipitating constituents.
3. (Once Amended) The process of Claim 1 further comprising affixing the heat sink to a microelectronic package including a die affixed to a carrier substrate.
4. (As filed) The process of Claim 1 further comprising prior to treating the heat sink to the cryogenic quenching process first treating the heat sink to a temperature high enough to lead to a secondary re-crystallization grain growth, which changes the microstructure of the heat sink from a fine grain to a coarse grain.
5. (As filed) The process of Claim 1 wherein the treating of the heat sink to the cryogenic quenching process includes gradually lowering the heat sink to a cryogenic temperature and then immediately raising the temperature of the heat sink.

6. (As filed) The process of Claim 4 wherein the changing of the microstructure of the heat sink from a fine grain to a coarse grain improves the thermal conductivity of the heat sink by reducing the number of grain boundaries in the heat sink that obstruct the movement of atomic and molecular species.

7. (As filed) The process of Claim 1 further comprising affixing the heat sink to a microelectronic die mounted to a package substrate.

8. (As filed) A process of fabricating a heat sink, comprising:
providing a heat sink comprised of a metal alloy;
raising the temperature of the heat sink to cause a secondary re-crystallization grain growth in the metal alloy; and
treating the heat sink to a cryogenic quenching process.

9. (As filed) The process of Claim 8 wherein the metal alloy has precipitating constituents.

10. (As filed) The process of Claim 8 wherein the thermal conductivity of the heat sink is improved by changing the microstructure of the metal alloy from a fine grain structure to a coarse grain structure.

11. (Once Amended) The process of Claim 8 further comprising fabricating the heat sink from an aluminum alloy.

12. (Once Amended) The process of Claim 8 further comprising fabricating the heat sink from a copper alloy.

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13. (As filed) The process of Claim 8 further comprising affixing the heat sink to a microelectronic die mounted to a package substrate.

14. (As filed) A process of fabricating a heat sink, comprising:
providing a heat sink; and
expanding the grain structure in the heat sink from a fine grain to a coarse grain to enhance the thermal conductivity of the heat sink.

15. (Once Amended) The process of Claim 14 further comprising fabricating the heat sink from a metal alloy with secondary re-crystallization grain growth.

16. (As filed) The process of Claim 15 further comprising treating the heat sink to a cryogenic quenching process by gradually lowering the heat sink to a cryogenic temperature and then immediately raising the temperature.

17. (Once Amended) The process of Claim 14 further comprising affixing the heat sink to a microelectronic package which includes a die affixed to a package substrate, the thermal conductivity of the heat sink improved by reducing the grain boundaries that obstruct the movement of atomic and molecular species.

18. (New) A process for enhancing the thermal conductivity of a heat sink for thermally coupling to a semiconductor die comprising:

raising a temperature of the heat sink to an elevated temperature high enough to change a microstructure of the heat sink from a fine grain to a coarse grain; and

lowering the temperature of the heat sink to a cryogenic temperature.

19. (New) The process of claim 18, comprising rapidly raising the temperature of the heat sink from the cryogenic temperature to a room temperature.
20. (New) The process of claim 18, wherein lowering the temperature of the heat sink to a cryogenic temperature comprises gradually lowering the temperature of the heat sink to an intermediate temperature above the cryogenic temperature prior to rapidly lowering the temperature of the heat sink from the intermediate temperature to the cryogenic temperature.
21. (New) The process of claim 20, comprising rapidly raising the temperature of the heat sink from the cryogenic temperature to a room temperature.
22. (New) The process of claim 19, comprising thermally coupling the heat sink to the semiconductor die.
23. (New) The process of claim 21, comprising thermally coupling the heat sink to the semiconductor die.
24. (New) The process of claim 19, wherein the elevated temperature is greater than 850 degrees Fahrenheit and the cryogenic temperature is approximately -327 degrees Fahrenheit.
25. (New) The process of claim 20, wherein rapidly lowering the temperature of the heat sink to the cryogenic temperature comprises placing the heat sink in a bath of liquid nitrogen.